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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

STAHL, MICHAEL J

ART UNIT	PAPER NUMBER
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2874

DATE MAILED: 01/20/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/035,829	NOVOTNY ET AL.	
	Examiner	Art Unit	
	Mike Stahl	2874	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 November 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-68 is/are pending in the application.
- 4a) Of the above claim(s) 56-68 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 27-37 and 39-50 is/are allowed.
- 6) ☒ Claim(s) 1-5, 7, 8, 10-26, 38 and 51-55 is/are rejected.
- 7) ☒ Claim(s) 6 and 9 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>see action</u> | 6) <input type="checkbox"/> Other: _____ |

Election/Restrictions

Claims 56-68 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the response received November 28, 2003.

Information Disclosure Statement

The information disclosure statements submitted July 8 2002, May 15 2003, and June 10 2003 have been considered and made of record, with the exception of documents 7-10 listed on the July 8 statement. These documents were not scanned into the electronic image file wrapper and original paper copies could not be located. Initialed copies of the PTO-1449 forms are attached.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 38 and 51 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 38 is indefinite because it is in conflict with parent claim 27. Claim 38 recites that each arm of each first serpentine hinge is contoured to coincide with the shape of the periphery of the mirror, and that each arm of each second serpentine hinge is contoured to coincide with the shape of the periphery of the frame element. However, claim 27 recites that the first

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serpentine hinges connect the frame element to the support structure and that the second serpentine hinges connect the movable optical element to the frame element. Thus it appears that the arms of the first hinges should conform to the peripheral shape of the frame element and that the arms of the second hinges should conform to the peripheral shape of the mirror.

Claim 51 is indefinite for a similar reason with respect to parent claim 43 (claim 51 recites that the arms of the first hinge conform to the shape of the mirror, but claim 43 recites that the first hinge connects the support structure to the first frame element). Claim 51 is also indefinite because it recites that the arms of the second serpentine hinges are contoured to coincide with the shape of the periphery of the frame element, whereas claim 43 refers to three distinct frame elements so it is not clear which frame element claim 51 refers to. It appears that the arms of the second hinges should conform to the peripheral shape of the third movable frame element, and that the arms of the first hinges should conform to the peripheral shape of the first movable frame element.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

Claims 11, 14-17, 20, and 24 are rejected under 35 U.S.C. 102(a) as being anticipated by McClelland et al. (US 6201629).

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Claims 11 and 14: McClelland discloses an optical device assembly comprising a movable optical element **4/41** having an outside edge joined to a base **40** by a pair of serpentine hinges **49**; driving elements which deflect the optical element **4/41**; and a damping element **57**, **58**, **60**, or **98** (figs. 13A-14D; col. 12 line 46 – col. 13 line 36). Since McClelland describes use of the disclosed micromirror in a video display system having a plurality of pixels (see e.g. background or claim 32), it is considered within the scope of the reference to assemble a number of individual complete optical device assemblies in a two-dimensional array on a common substrate, wherein the substrate would act as the support structure in the meaning of claim 11. Each optical element would be joined to this support structure by way of serpentine hinges **49** and respective bases **40**.

Claim 15: The movable optical element **4/41** comprises a mirror **3** having a reflective surface.

Claim 16: The movable optical element may alternatively include a grating (col. 17 lines 65-67).

Claim 17: The damping element **57**, **58**, **60**, or **98** comprises a damping agent means.

Claim 20: The serpentine hinges **49** comprise at least one winding having two arms.

Claim 24: It is considered inherent that the serpentine hinges **49** provide some amount of damping for the motion of the optical element **4/41**, such that the shape of the serpentine hinges acts as a damping element.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-5, 7-8, 10-23, 25-26, and 52-55 are rejected under 35 U.S.C. 103(a) as being unpatentable over Temesvary et al. (US 2002/0130561) in view of McClelland et al. (US 6201629). The filing date of provisional application 60/277,135 is being relied on as the effective filing date for the Temesvary reference.

Claim 1: Temesvary discloses an apparatus (fig. 1) comprising an optical element 10 capable of motion in at least one degree of freedom, wherein the motion is enabled by serpentine hinges 4, and driving elements 12, 14, 16, 18 configured to deflect the optical element. Temesvary does not disclose a specific damping element. McClelland discloses a similar optical deflector apparatus and teaches that the movable optical element may be damped by applying a damping material to various parts of the apparatus or by mechanically coupling separate damping devices to the moving structures (col. 13 lines 1-36). McClelland suggests that it may be desirable to provide higher damping for one of the rotation axes. Since the Temesvary apparatus is intended to be used in multiples in an optical switching array, it would appear to be advantageous to damp one of the rotation axes particularly when the dimensions of the array are unequal. Thus it would have been obvious to a person having ordinary skill in the art to provide the Temesvary apparatus with a damping element as suggested by McClelland. The proposed modification meets the limitations of claim 1.

Claim 2: The optical element **10** is made from single crystal silicon ([0038] and [0061]).

Claim 3: The optical element is movable in two degrees of freedom which are defined by respective pairs of serpentine hinges **4**.

Claim 4: A damping element is a damping means.

Claim 5: McClelland teaches application of a damping agent **57** to the hinges which define the rotation axes (fig. 14A). This teaching is incorporated into the proposed modification.

Claim 7: Optical element **10** includes a reflective surface.

Claim 8: Temesvary teaches that a plurality of the apparatuses may be configured in an array ([0073]).

Claim 10: Temesvary does not specifically disclose a wavelength router, but wavelength routers having an optical cross-connect switch and a multiplexer are already known in the art. Temesvary teaches that a number of the apparatuses may be incorporated into an optical cross-connect switch ([0073] and [0055]). It would have been obvious to a skilled person to use the Temesvary cross-connect switch in an otherwise conventional wavelength router in order to exploit the advantageous features of the Temesvary design.

Claims 11 and 14: The proposed modification includes all the limitations of an individual optical device assembly as set forth in claim 11. Temesvary further teaches that a number of the assemblies can be disposed on a common support structure, that is, in an “integrated planar array of optical switch units on a same substrate” as described at [0073].

Claims 12 and 13: As to claim 13 the serpentine hinges **4** have an exemplary thickness of 10 microns ([0043]), which is less than the nominal thickness of the entire movable element **6** (including the mirror portion **10**) which is around 60 microns ([0060]) as required by claim 13.

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As to claim 12, it would have been obvious to a skilled person to alternatively design the hinges and the movable element with equal thicknesses, for example, to simplify the fabrication process by eliminating a step of reducing the thickness of the hinges.

Claim 15: The movable optical element includes a mirror **10**.

Claim 16: Temesvary discloses that the movable optical element may act as a blocker, i.e. to block beams propagating between fibers and receivers ([0018]).

Claims 17 and 18: See comments for claims 4 and 5 above.

Claim 19: The damping agent taught by McClelland may be a polymeric material (col. 13 lines 12-18).

Claim 20: Each hinge **4** has at least one winding, with each winding having two arms.

Claim 21: A portion (the portion near the outer corners of the device in fig. 1) of each arm of each winding of each hinge extends in a direction transverse to the rotation axis defined by a respective hinge pair.

Claim 22: An alternate embodiment shown in Temesvary fig. 12 includes serpentine hinges **104** having a shape which conforms to the peripheral shape of the mirror **105** thereby defining circumferentially curved serpentine hinges.

Claim 23: The arms of each serpentine hinge **4** have a proximal fold which shapes the proximal portion of each arm such that it extends in a direction parallel to the rotation axis defined by the respective pair of hinges.

Claim 25: Each winding of serpentine hinge **104** of the fig. 12 embodiment gets progressively shorter from the optical element end to the support structure end.

Claim 26: Each winding of serpentine hinge 4 of the fig. 1 embodiment gets progressively longer from the optical element end to the support structure end.

Claims 52-55: The limitations of these claims are satisfied by aspects of the proposed combination described above.

Allowable Subject Matter

Claims 6 and 9 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 27-37 and 39-50 are allowed.

Claims 38 and 51 would be allowable if rewritten to overcome the rejections under 35 U.S.C. 112, second paragraph, set forth above and to include all of the limitations of the base claim and any intervening claims.

Claim 6: The applied references do not discuss or suggest providing a damping element by configuring the serpentine hinges to reduce the magnitude of resonances.

Claim 9: Neither applied reference teaches or suggests using torsional hinges with the serpentine hinges 4 to further enable a degree of freedom.

Claims 27-51: Neither applied reference by itself meets all the limitations of independent claims 27 or 43. For example, Temesvary discloses serpentine hinges used to define rotation axes, but does not disclose a movable frame element. McClelland discloses a movable frame element but uses torsional hinges instead of serpentine hinges for enabling rotation. There is no

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apparent motivation to combine these diverse structural features of these references in the manner needed to satisfy claims 27 or 43. It is further noted with respect to claim 43 that neither reference teaches or suggests using both torsional hinges and serpentine hinges in the same device to define rotation axes. Claims 28-42 and 44-51 are allowable by dependence from claims 27 and 43 respectively (claims 38 and 51 being subject to revision or argument to overcome the indefiniteness rejection as noted above).

Conclusion

If a copy of a provisional application listed on the bottom portion of the accompanying Notice of References Cited (PTO-892) form is not included with this Office action and the PTO-892 has been annotated to indicate that the copy was not readily available, it is because the copy could not be readily obtained when the Office action was mailed. Should applicant desire a copy of such a provisional application, applicant should promptly request the copy from the Office of Public Records (OPR) in accordance with 37 CFR 1.14(a)(1)(iv), paying the required fee under 37 CFR 1.19(b)(1). If a copy is ordered from OPR, the shortened statutory period for reply to this Office action will not be reset under MPEP § 710.06 unless applicant can demonstrate a substantial delay by the Office in fulfilling the order for the copy of the provisional application. Where the applicant has been notified on the PTO-892 that a copy of the provisional application is not readily available, the provision of MPEP § 707.05(a) that a copy of the cited reference will be automatically furnished without charge does not apply.


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The references made of record and not relied upon are considered pertinent to applicant's disclosure: US 6360035 discusses damping effects of air surrounding an MEMS-type mirror (cols. 26-27). US 6577793 discloses an MEMS-based optical switch using a steerable lens rather than a mirror. US 6556739 teaches damping an MEMS device by shaping the actuation signal.

Any inquiry concerning this communication should be directed to Mike Stahl at (703) 305-1520 prior to January 12, 2004 or (571) 272-2360 after that date. Official communications which are eligible for submission by facsimile and which pertain to this application may be faxed to (703) 872-9306. Inquiries of a general or clerical nature (e.g., a request for a missing form or paper, etc.) should be directed to the Technology Center 2800 receptionist at (703) 308-0956 or to the technical support staff supervisor at (703) 308-3072.

MJS

Michael J. Stahl
Patent Examiner
Art Unit 2874


AKIM ENAYET ULLAH
PRIMARY EXAMINER

January 6, 2004